Specialization:	Electrical Engineering		Palestinian National Authority Ministry of Education & Higher Education Palestine Technical University College of Engineering & Technology Second Exam First semester 2010/2011
Course Name:	Electrical Machine 1		
Date:	20/03/2011		
Time:	11:00-12:00		
Instructor:			
Name:	[redacted]	Section: 11 —10	21+2/50

Notes: (Answer **all** questions)   د. أنيس أبو سنينة   23/50

Question #	1	2	3	4	Total Grade
Grade					

Q1) (15 points) (10.5)

Choice the correct answer:

تم الرفع بواسطة م. معن أبو عيسى

1- The rotational losses of dc motors can be measured through:
(a) no load test (b) blocked rotor test (c) full load test

2- The mode of constant torque of dc motors occurs when :
(a) increasing both armature voltage and field current
(b) increasing the armature voltage and the flux remains unaffected
(c) decreasing the flux at constant armature voltage

3- Which one of the following motors will run away, if operated without load:
(a) series dc motor (b) separately dc motor (c) compound dc motor

4- In a dc generators, the voltage regulation measures
(a) the shape of speed-torque characteristics
(b) the shape of voltage-load current characteristics
(c) the shape of voltage-field current characteristics

5- Constant power mode of dc motor occurs when:
(a) decreasing the flux and armature voltage increasing
(b) increasing the armature voltage and the flux remains unaffected
(c) decreasing the flux at constant armature voltage

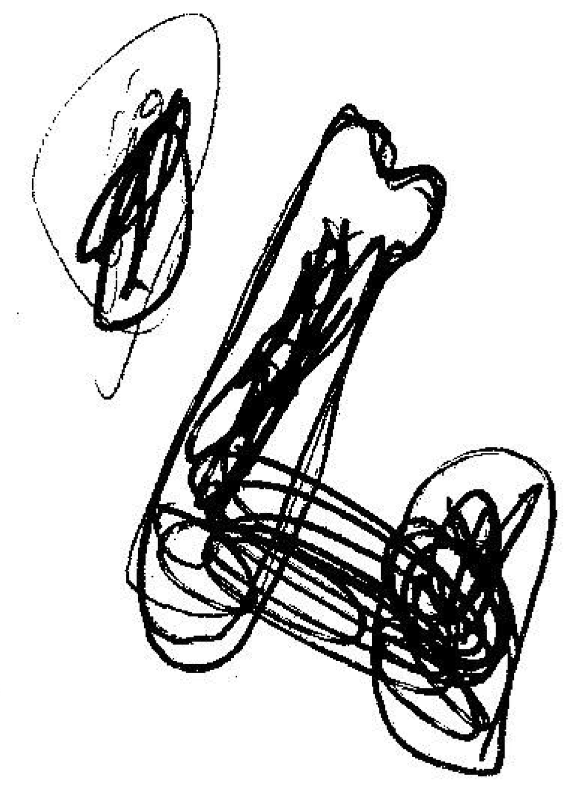
6- The basic of self-excitation of dc machines depends on an existing of
(a) voltage of the field circuit (b) armature voltage
(c) residual magnetism of the stator iron (d) residual magnetism of the rotor iron

7- In series dc motors, the consumed current at 25 % loading is:
(a) ¾ of the rated current (b) ½ full rated current (c) ¼ of the rated current

8- Which one of the following motors is unsuitable for any application:
(a) Series dc motor. (b) Cumulatively compound dc motor.
(b) Differentially compound dc motor.

9- Which one of the following machine is suitable for arc welding:
(c) Series dc motor. (b) Series dc generator.
(d) Differentially compound dc motor. (d) Differentially compound dc generator.

10- The speed control of permanent-magnet (PM) dc motor is obtained through:
(a) Armature voltage (b) field current (c) either (a) or (b)



Q2) (14 points) (4)

A shunt DC generator is shown in Fig. 1. The shunt field resistor Radj is adjusted to 180 Ω, and the generator's rated speed is **1200 rpm**. Magnetization curve is shown in Fig. 2.

(a) What is the no-load terminal voltage of the generator at **1000 rpm**?

at no load $E_A = V_T$ (1)

$I_F = \frac{V_T}{R_F + R_{adj}}$ 216

$n_2 = \frac{E_A}{E_{A0}} n_0$

$1000 = \frac{E_{A2}}{E_{A0}} * 1200$

$1000 = \frac{E_A}{290} * 1200 \Rightarrow E_A = \frac{260000}{1200} = 241.6$

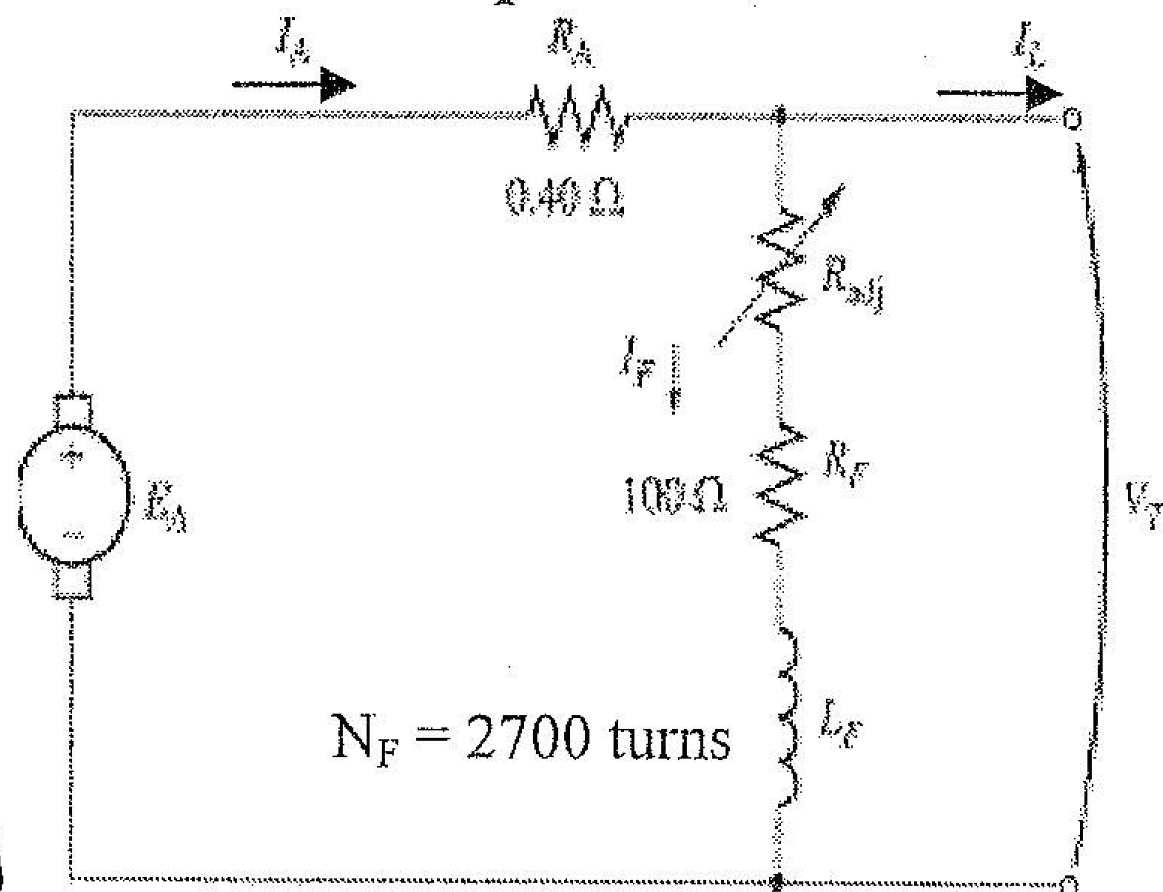


Fig. 1

(b) What is the terminal voltage of the generator at rated speed with an **armature current of 100 A**?

(3)

$E_A = V_T - I_A R_A$

$= 241.6 - 100(0.4)$

$= 241.6 - 40$

$= 201.6V$

E_A at 201.6V

$I_f = 0.48A$

$n_2 = \frac{201.6}{241.6} * n_0$

$n_2 = \frac{E_A}{E_0} n_0$

$E_A = \frac{n_2 E_0}{n_0}$

$E_A = \frac{1001 * 241.6}{1200}$

$V_T = 201.6V$

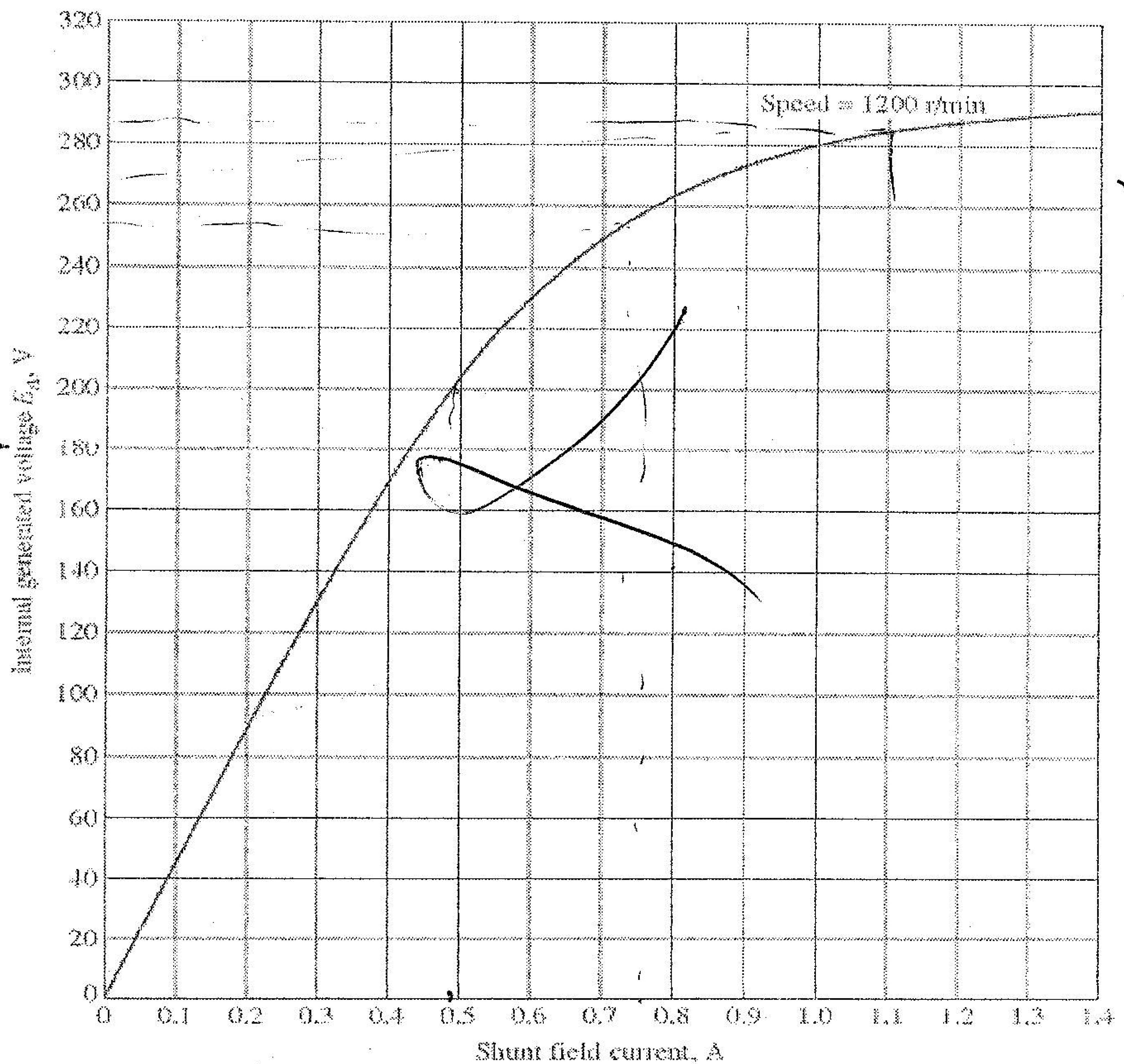
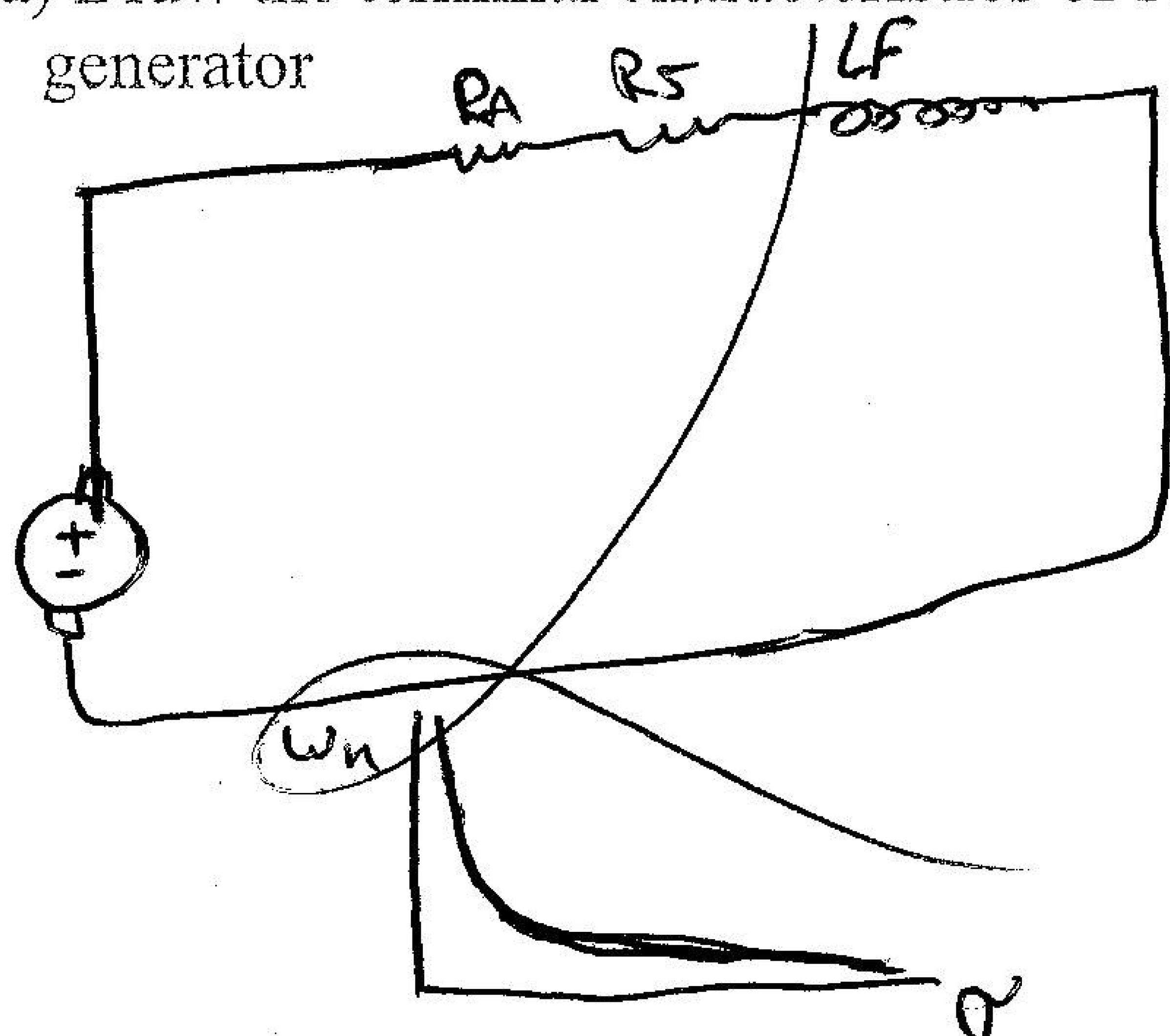


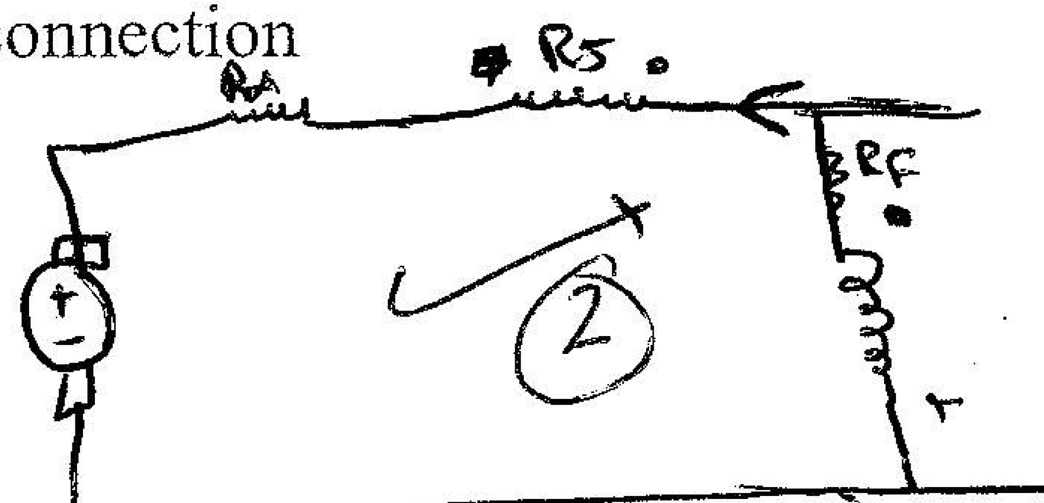
Fig. 2

Q3) (6 points) (2)

a) Draw the terminal characteristics of series dc generator



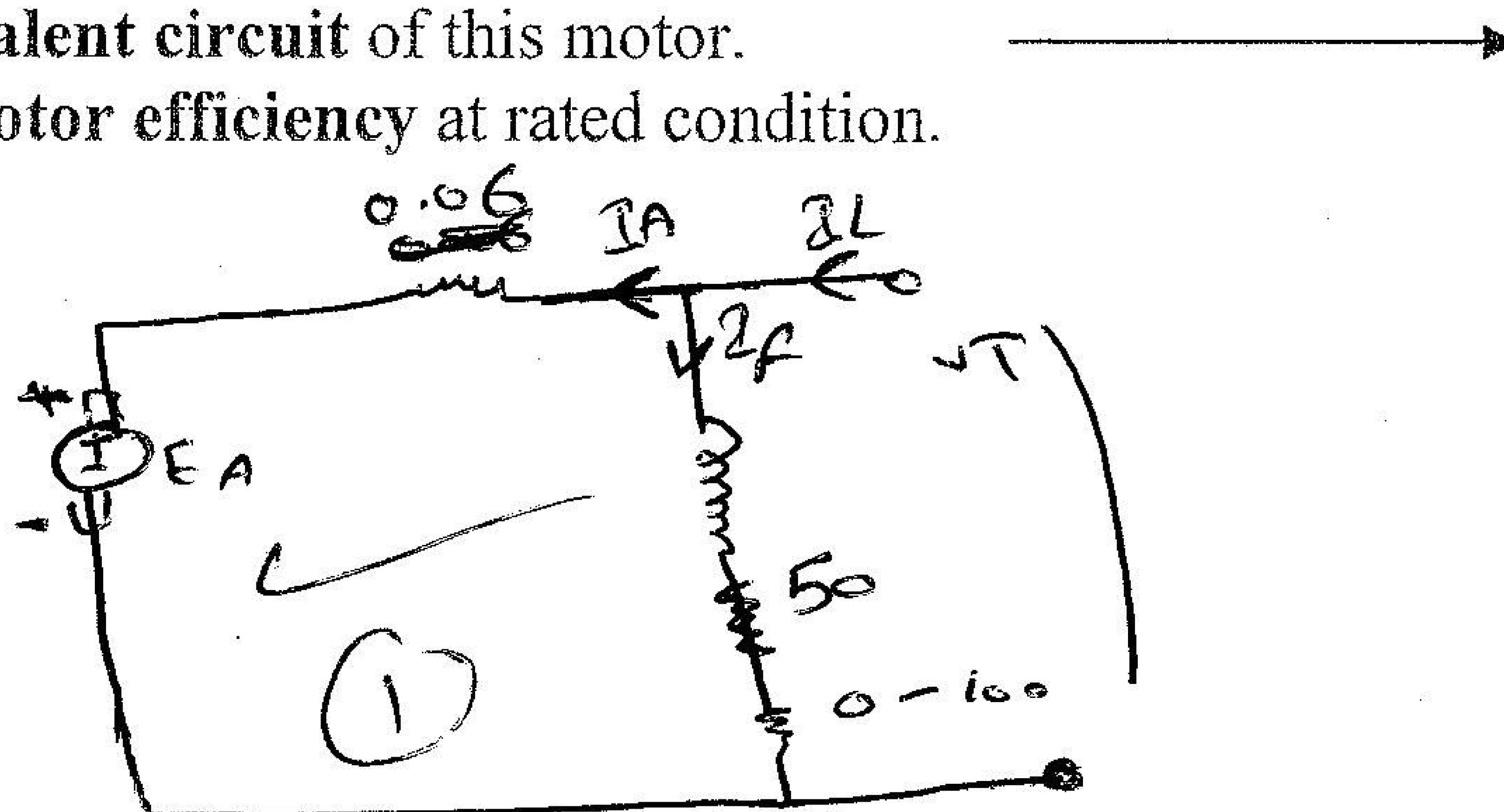
b) Draw the equivalent circuit of cumulative compound dc motor with long-shunt connection



Q4) (15 points) (4)

A **50 hp, 250V, 1200rpm** shunt dc motor has an armature resistance of **0.06Ω** and field resistance of **50 Ω** at which the field current is rated. The armature current is **170 A**. The adjust resistance $\mathbf{R_{adj}}$ = **0-100 Ω.**

1- Draw the **equivalent circuit** of this motor.
2- Calculate the **motor efficiency** at rated condition.



the motor efficiency = $\frac{V_m - V_{FL}}{V_{FL}} \times 100\%$

$= \frac{250 - 239.8}{239.8 V} = 4.2\%$

3- Calculate the **maximum speed** in rpm for constant rated armature current.

The maximum speed at Radj = 100

$I_f = \frac{250}{150} = 1.66$ A (2)

$I_A = I_L - 1.66$

$170 = I_L - 1.66 \Rightarrow I_L = 171.66A$

$E_A = V_T - I_A R_A = 250 - 170(0.06) = 250 - 10.2 = 239.8$ V (1)

$E_1 = E_2$

$E_{A1} = K\phi w_1 = E_{A2} = K\phi w_2$

$\frac{E_{A2}}{E_{A1}} = \frac{K\phi w_2}{K\phi w_1}$

$= \frac{K\phi_2 w_2}{K\phi_1 w_1}$

$T_1 = K\phi I_A$

$\frac{T_2}{T_1} = \frac{K\phi_2 I_{A2}}{K\phi_1 I_{A1}}$

$= \frac{\phi_2 I_{A2}}{\phi_1 I_{A1}}$

(End of Exam)